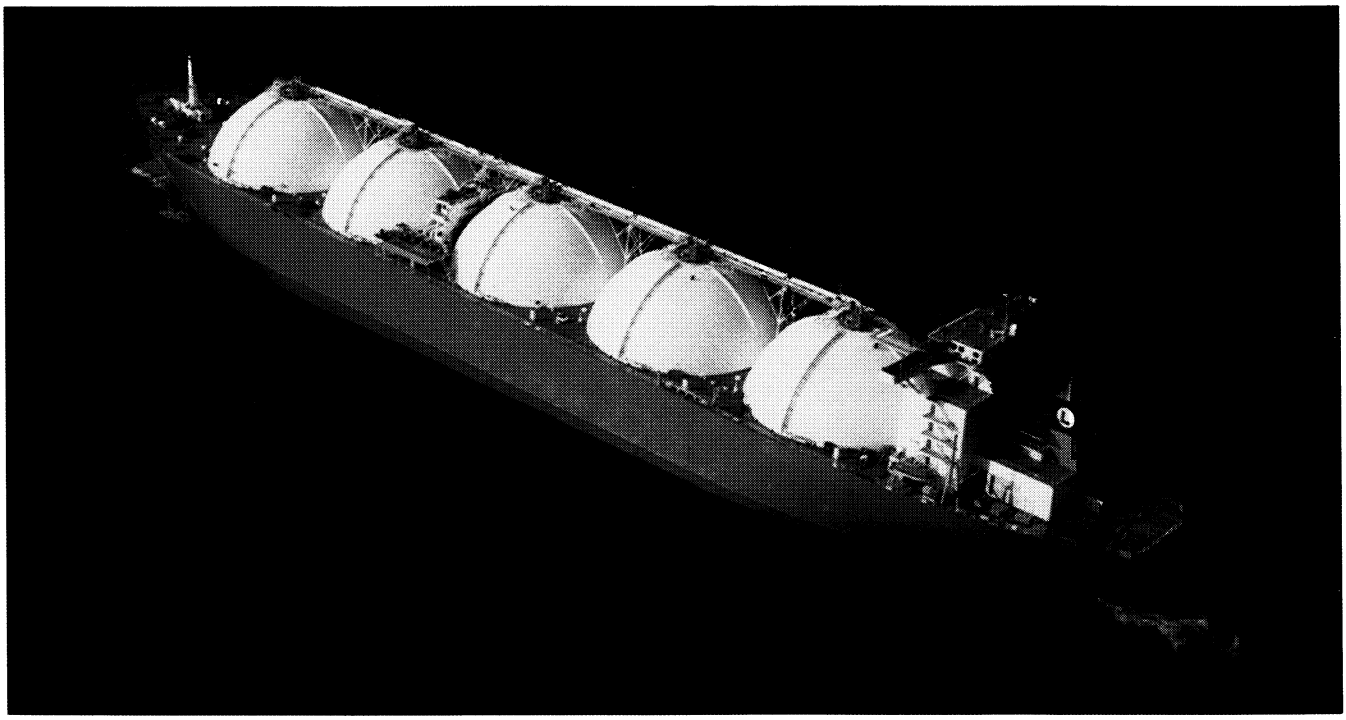
Spinoff systems for monitoring supercold fluids highlight technology transfers in the field of industrial productivity

From Lift-Off to Light-Off

The largest and heaviest element of the Space Shuttle is the 154-foot long external fuel tank, which feeds 1.5 million pounds of propellants to the Shuttle's three main engines during ascent to orbit. The propellants are "cryogenics" which must be maintained at supercold temperatures—minus 434 degrees Fahrenheit in the case of the liquid hydrogen fuel and minus 326 degrees for the liquid oxygen oxidizer. The engines gulp the huge tank dry in just over eight minutes—so the tank loses weight at the rate of almost 100 tons a minute.

It is essential that the Shuttle's computers be informed of these rapid changes in vehicle weight. The computers must also know when the tank runs dry, so they can shut down the engines. These jobs, crucial to mission success and crew safety, fall to a highly precise measurement system, necessarily sophisticated because of the cryogenic nature of the propellants. The system must take into account density, temperature, pressure and the specific configurations of the two separate containers housing the fuel and the oxidizer. These factors are determined by a number of sensors, whose inputs are fed to a signal conditioner and processed for accurate, continuous readouts of

Carrying cargoes valued at $15 million per shipload, tankers like the one below transport approximately 550 billion cubic feet of liquefied natural gas (LNG) a year. A space-spinoff, Simmonds Precision's LNG measurement and monitoring system aids accurate financial accounting and enhances crew safety. At left, engineers examine a segment of a 120-foot sensor employed in the measurement process.



Among other aerospace spinoffs developed by Simmonds Precision are an advanced ignition system for industrial boilers (left) that offers savings of millions of gallons of fuel, and a computer-based monitoring and control system for improving safety and reliability in electrical utility applications (below).

propellant status from liftoff to engine shutdown.

The Shuttle's propellant measurement system is produced by Simmonds Precision, Tarrytown, New York, an old hand at monitoring space-use cryogenics; the company built similar equipment for the Apollo spacecraft and the later Skylab manned orbiting research station. Simmonds also has extensive experience in fuel management systems and other equipment for military and commercial aircraft. The company's aerospace-acquired expertise has led to a number of non-aerospace spinoffs which prompted formation of a separate corporate entity, the Industrial Controls Division.

An example of a Simmonds spinoff is a "custody transfer" system for measuring and monitoring liquefied natural gas (LNG). A cryogenic, LNG is transported aboard large tankers at minus 260 degrees Fahrenheit. The value of a single shipload may reach $15 million, so accurate measurement of the LNG transferred to and from the ship is financially important. Additionally, proper monitoring of the volatile LNG aboard sea-going vessels is vital to crew safety. Applying its aerospace-developed cryogenics measurement technology, Simmonds has provided custody transfer systems for 10 LNG tankers—built by Quincy (Massachusetts) Shipbuilding Division of General Dynamics Corporation—which are operating between Indonesia and Japan.

Simmonds has also provided measurement systems for several liquefied petroleum gas (LPG) production and storage installations, for example, an Atlantic Richfield Indonesia offshore terminal in the Java Sea. Built on a barge, the terminal receives, liquefies, stores and transfers LPG to ships for worldwide distribution; Simmond's instrumentation is used in a number of these operations. The same type of system is used for land-based LPG inventory and control system in the state of Washington.

Another adaptation of aerospace technology to the industrial marketplace involves the application of jet engine ignition know-how to conservation of fuel in industrial boilers. The energy savings result from the fact that these advanced igniters can "lift off" heavy industrial fuels without a preliminary ignition step. This is particularly important in the case of pulverized coal, an increasingly popular fuel in industrial boiler applications. Conventional burners require that a fuel with a lower ignition point—such as oil—be lighted first; the burning oil, in turn, fires the coal. With a Simmonds industrial ignition system, the coal is ignited directly and the preliminary burning is eliminated.

In still another industrial sector spinoff, Simmonds produces a line of aerospace-derived safety systems for nuclear and non-nuclear electrical power plants. These systems employ minicomputer technology to monitor continuously and display critical operating variables; they automatically shut down the plant when unsafe conditions are detected.